

CASA IMMUNIZATION COVERAGE SURVEY

2004



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ACRONYMS

4-3-1-3-3	4 doses of DTP, 3 doses of Polio, 1 dose of MMR, 3 doses of Hib, and 3 doses of HepB vaccines
3-2-2-2	3 doses of DTP, 2 doses of Polio, 2 doses of Hib, and 2 doses of HepB vaccine
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
CASA	Clinic Assessment Software Application
CDC	Centers for Disease Control and Prevention
CII	National Childhood Immunization Initiative
DTP	Diphtheria, tetanus, and pertussis vaccine
HepB	Hepatitis B vaccine
Hib	<i>Haemophilus influenza</i> type b vaccine
KDHE	Kansas Department of Health and Environment
MMR	Measles, mumps, and rubella vaccine
MOGE	Moved out of the area or going elsewhere for health care
NIS	National Immunization Survey
Polio	Polio vaccine
PNU	Pneumococcal vaccine
PHS	Public Health Services
VAR	Varicella vaccine

CASA 2004 EXECUTIVE SUMMARY

To determine whether Kansas reached the 90% coverage goals set by Healthy People 2010, immunization coverage rates of children two-years of age in 2004 were assessed at all 105 local health departments. Coverage rates in the two-year old cohort for 4 doses of diphtheria, tetanus, and pertussis (DTP4), 3 doses of polio (Polio3), 1 dose of measles, mumps, and rubella (MMR1), 3 doses of *H. influenzae* (Hib3), 3 doses of hepatitis B (HepB3), and 1 dose of varicella (VAR1) were measured. This is the initial report of the immunization coverage rates for the pneumococcal conjugate (PNU) vaccine in the two-year old cohort. The vaccine series of DTP4, Polio3, MMR1, Hib3, and HepB3 (4-3-1-3-3) was analyzed as well. In order to identify non-immunized children sooner, one-year old children were also included in this assessment. Evaluation of coverage rates for the one-year old children in 2004 included the following: 3 doses of diphtheria, tetanus, and pertussis (DTP3), 2 doses of polio (Polio2), 2 doses of *H. influenzae* (Hib2), 2 doses of hepatitis B (HepB2), 3 doses pneumococcal (PNU3) individually and the combination of DTP3, Polio2, Hib2, and HepB2 (3-2-2-2).

In the two-year old cohort, the number of local health departments achieving the 90% coverage goal was similar to the number of counties in 2003 except for DTP4, Var1, and 4-3-1-3-3 series. The number of local health department reaching at least 90% increased for DTP4, 4-3-1-3-3 and Var1, doubled compared to 2003. The county mean immunization coverage rates remained the same as last year for all vaccines except DTP4 and the 4-3-1-3-3 series. From 2000 to 2003, mean coverage rates for the 4-3-1-3-3 declined by more than 16 percentage points. This is a reflection of the declining DTP4 mean coverage rates which have also declined each year since 2000. However in 2004, coverage rates for DTP4 and 4-3-1-3 increased by 15 percentage points. The mean coverage rate for 4-3-1-3-3 in 2004 was comparable to the mean coverage rate in 2001.

Counties were categorized by population density and coverage rates were compared among these groups. Mean coverage rate estimates were lowest among the “moderately populated” group for all vaccines and 4-3-1-3-3 when compared to the other two groupings.

In the one-year old cohort for 2004, the statewide mean coverage rates were similar to the rates from 2003, except for PNU3. Mean coverage rates for PNU3 increased by 9 percentage points. For Polio2, Hib2, and HepB2, mean coverage rates were once again better than 90%.

Children in the one-year old cohort who are on time at 3 months of age are just over twice as likely to be up-to-date at 12 months of age compared to those children who do not begin the series on time (relative risk ratio 2.13). Children in the two-year old cohort who started their immunization series on time were 60% more likely to complete the series than those who started late. At two-years of age, 9% of the children needed only one immunization to be up-to-date. For these children requiring just one immunization, 83% were missing DTP4.

BACKGROUND

Immunization of children has proven effective in reducing morbidity and mortality from vaccine preventable diseases. For this reason, Healthy People 2010 has set goals of 90% immunization coverage of nine diseases for all children by their second birthday¹. The following vaccines and a series of all vaccines are included: 4 doses of diphtheria, pertussis, and tetanus vaccine (DTP4); three doses of polio vaccine (Polio3); one dose of measles, mumps, and rubella vaccine (MMR1); three doses of *Haemophilus influenzae* type b vaccine (Hib3); three doses of hepatitis B vaccine (HepB3); and 1 dose of varicella (VAR1). This is the initial report of the immunization coverage rates for the pneumococcal conjugate (PNU) vaccine in the two-year old cohort. The combination of DTP4, Polio3, MMR1, Hib3, and HepB3 is referred to as the 4-3-1-3-3 series.

Even though no immunization coverage goals for one-year old children have been established, according to the recommended schedule children are recommended to receive the following immunizations by their first birthday: 3 doses of diphtheria, pertussis, and tetanus vaccine (DTP3); two doses of polio vaccine (Polio2); two doses of *Haemophilus influenzae* type b vaccine (Hib2); two doses of hepatitis B vaccine (HepB2) and pneumococcal vaccine (PNU). The complete set DTP3, Polio2, Hib2, and HepB2 is referred to as the 3-2-2-2 combination. One-year old children were included in this assessment in order to estimate the magnitude of non-immunized and under immunized children with the objective of having these children receive all immunizations by their second birthday.

The field staff at the Immunization Program from Kansas Department of Health and Environment assessed immunization levels of both two-year old and one-year old children at all local health departments. The assessments included in this study were conducted between January 1, and December 31, 2004.

METHODS

Vaccine coverage for PNU4 was calculated using children who had received the first dose of PNU before 7 months of age.

RESULTS

TWO-YEAR OLD COHORT

Children included in the two-year old cohort were born between January 2001 and December 2002. For the two-year old cohort, 8516 records were reviewed with a range of 5 to 787 records from 105 counties. The mean number of records examined per county for the two-year old cohort was 81 with a median of 47 records. Records were also grouped and examined for each of the population density groups. The distribution of the records by population density is: “sparsely populated” accounts for 31% (n=2636) records, “moderately populated” for 52% (n=4448) records and “urban” counties for 17% (n=1432) records.

Statewide Mean and Range of Immunization Coverage for Single and Series of Vaccines

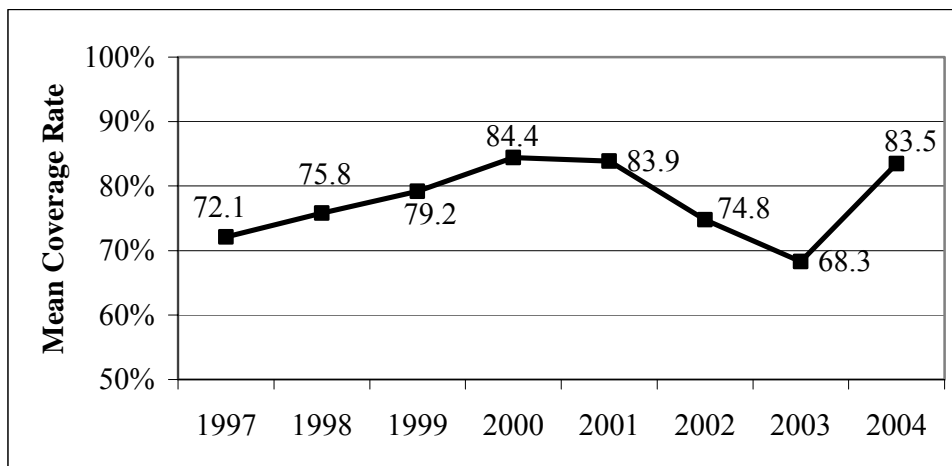
In the two-year old cohort, the statewide mean coverage rates for all vaccines except for DTP4 have remained the same compared to the 2003 CASA. The mean coverage rates exceeded the coverage goal of 90% for Polio3, MMR1, Hib3, and HepB3 (Table 1). The mean coverage rates for DTP4 and 4-3-1-3-3 have increased from the mean coverage rates in 2003. This increase comes after three years of decrease (Figure 1).

¹ <http://www.healthypeople.gov>

Table 1: Immunization Coverage Rate Mean and Range for the Two-Year Old Cohort at County Health Departments for 2004 CASA.

Vaccine	Mean (%)	Range (%)
DTP4	84.7	38.1 - 100
Polio3	93.5	60 - 100
MMR1	93.3	51.7 - 100
Hib3	94.0	60 - 100
HepB3	93.6	58.6 - 100
4-3-1-3-3	83.5	33.3 - 100
VAR1	70.3	8.2 - 100

Figure 1: Mean Immunization Coverage Rates in the Two-Year Old Cohort for the 4-3-1-3-3 combination at County Health Departments in Kansas.



In February 2000, a new pneumococcal conjugate vaccine was licensed for all children less than 2 years of age and children aged 2-5 years who are at increased risk for pneumococcal disease. Mean immunization coverage rates were examined for all for doses which are scheduled to be administered at 2, 4, 6, and 12-15 months of age². Mean immunization rates in 2004 for each dose of the pneumococcal vaccine have increased compared to rates in 2003 (Table 2). Children who do not start the PNU vaccine series until 7 months of age receive only 3 doses of vaccine instead of the 4 doses for children who begin at 2 to 6 months of age.

² CDC. Prevention of pneumococcal disease among infants and young children: recommendations of the Advisory Committee on Immunization Practices. MMWR 2000;49 (No. RR-9). <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr4909a1.htm>

Table 2: Immunization Coverage Rate Mean, Median, and Range for Pneumococcal Conjugate Vaccine in the Two-Year Old Cohort at County Health Departments, 2004 CASA.

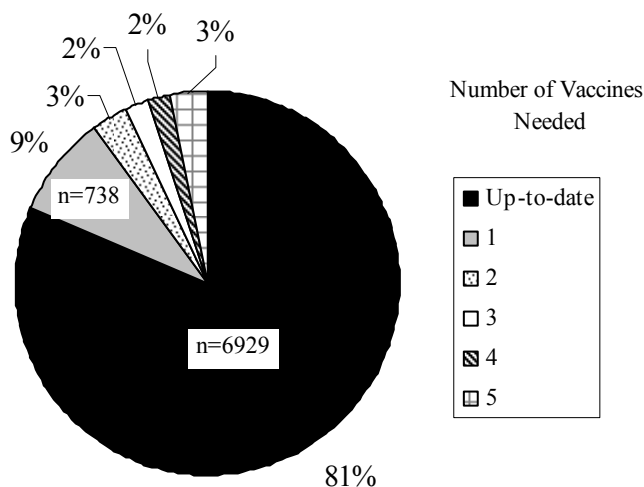
Vaccine	2003		2004	
	Mean (%)	Median (%)	Mean (%)	Median (%)
PNU1	71.6	78.5	80.1	87.5
PNU2	66.2	72.2	75.3	80.7
PNU3	55.2	57.7	64.6	67.6
PNU4*	46.6	47.8	49.7	50.0

* PNU4 applies only to children who received PNU1 before 7 months of age.

Children's up-to-date status at 3 months of age was compared to their up-to-date status at 24 months of age. At three months of age, 6985 children were up-to-date for DTP1, Polio1, Hib1, and HepB1. Of those children who started on time at 3 months, 88% (6087 children) had completed all necessary immunizations (DTP4, Polio3, Hib3, HepB3, and MMR1) on time by 24 months of age. Of the children who were late at 3 months of age 55% (842) completed all immunizations by 24 months of age. Statistically, children who start on time are 60% (relative risk ratio 1.6) more likely to complete the series on time by 24 months of age compared to those children who do not begin the series on time.

At 24 months of age, 1587 (19%) of all two-year olds were behind schedule. Of these children, 738 (50%) needed only one more immunization in order to be up-to-date. Of children needing just one immunization, 83% (611) needed DTP4 in order to be up-to-date at 24 months of age (Figure 2).

Figure 2: Number of Immunizations Needed in Order to Be Up-to-date at 24 Months of Age in Two-Year Old Cohort in Kansas, 2004 CASA.



*Children needing 2-5 vaccines to be up-to-date represent <300 children in each group.

Peer Groups

Counties were grouped together based on their population density. Estimated mean immunization coverage rates were compared among these groups (Table 3). Compared to the mean coverage rate

estimates of the other two groups, the mean coverage rate estimates for the “moderately populated” counties was lower for all vaccines and for the 4-3-1-3-3 combination. This trend was the same trend seen in the 2002 and 2003 CASA.

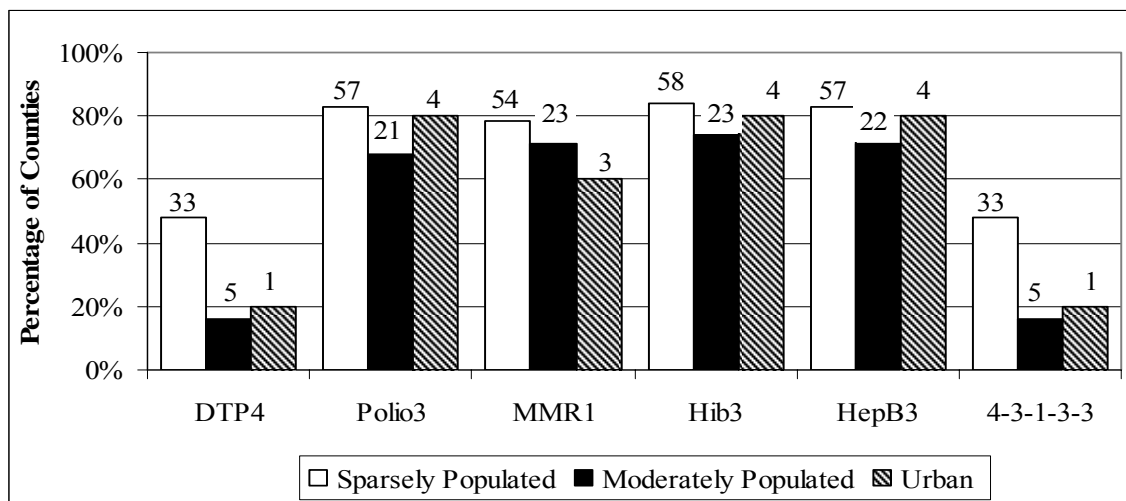
Table 3: Mean Immunization Coverage Estimates (%) Among Counties in Kansas Based on Population Density for Two-Year Old Cohort, 2004 CASA.

	Counties by Population Density - Collapsed Groups		
Vaccine	Sparsely Populated (n=69)	Moderately Populated (n=31)	Urban (n=5)
DTP4	87.5%	79.0%	81.2%
Polio3	94.8%	90.8%	92.4%
MMR1	94.9%	90.1%	92.0%
Hib3	95.6%	90.8%	92.2%
HepB3	94.7%	91.5%	91.7%
4-3-1-3-3	86.1%	78.2%	79.7%
VAR1	73.7%	63.1%	66.5%
PNU3	66.9%	60.5%	56.4%

Counties achieving the 90% Goal

The immunization coverage rate goal is 90% or better for single vaccines and for the combination of vaccines. The number of local health departments achieving 90% or better for 4-3-1-3-3 series increased from 26 local health departments in 2003 to 39 in 2004. For VAR1, the number of local health departments reaching at least 90% coverage has doubled to 18 from 2003 to 2004. The majority of the counties are located in the western third of Kansas (Appendix 2). “Sparsely populated” counties have a higher percentage of counties achieving at least 90% coverage for all vaccines compared to the other peer groups (Figure 3). The difference is statistically significant for DTP4 and 4-3-1-3-3 series ($\chi^2 = 9.87$, $p = 0.007$). For DTP3, the difference in the mean coverage rates is not statistically significant ($\chi^2 4.61$, $p = 0.1$). All other vaccines except VAR1 were analyzed and the difference in the number of counties reaching at least 90% is not statistically significant.

Figure 3: Percentage and Counts of Counties in Kansas Based on Population Density Achieving at Least 90% Immunization Coverage for Vaccines in the Two-Year Old Cohort, 2004 CASA.



ONE-YEAR OLD COHORT

Children included in the one-year old cohort were born between January 2002 and December 2003. For the one-year old cohort, 9095 records were reviewed with a range of 5 to 864 records from 103 counties³. In the one-year old cohort, a mean of 88 records and a median of 44 records per county were reviewed. Records were also grouped and examined for each of the population density groups. The distribution of the records by population density is: “sparsely populated” accounts for 34% (n=2998) records, “moderately populated” for 45% (n=4141) records and “urban” for 21% (n=1956) records.

Statewide Mean and Range of Immunization Coverage for Single and Series of Vaccines

Mean coverage rates for Polio2, Hib2, and HepB2 exceeded 90% (Table 4). Compared to the one-year old cohort in 2003, the mean immunization coverage rates remained the same except for PNU3 which increased by 9 percentage points.

Table 4: Immunization Coverage Mean and Range for One-Year Old Cohort at County Health Departments in Kansas for 2004 CASA.

Vaccine	Mean (%)	Range (%)
DTP3	81.5	25.0-100
Polio2	90.9	46.4-100
Hib2	91.5	61.2-100
HepB2	92.2	56.0-100
3-2-2-2	80.7	25.0-100
PNU3	53.9	5.7-85.4

³ Bourbon and Kingman Counties had no one year olds in database.

The likelihood of being up-to-date for the 3-2-2-2 combination by 12 months of age depending on the up-to-date status at 3 months of age was also examined. At 3 months of age, 7211 children were up-to-date for DTP1, Polio1, Hib1, and HepB1. Of those children up-to-date at 3 months of age, 88% (6380 children) were up-to-date at 12 months of age for DTP3, Polio2, Hib2, and HepB2. However, only 41% (781) of those children behind schedule were up-to-date at 12 months of age. Children who are on time at 3 months of age are just over twice as likely to be up-to-date at 12 months of age compared to those children who do not begin the series on time (relative risk ratio 2.13).

Peer Groups

The counties in the “sparsely populated” group had the highest coverage rate estimates for the 3-2-2-2 combination and all single vaccines compared to the “moderately populated” and “urban” groups of counties (Table 5). This trend and results were similar to those seen in 2002 and 2003 CASA. However, the disparities among the counties are less than in 2003 CASA. For example the 3-2-2-2 combination in 2003 CASA ranged from 76.4% to 83.5% and in 2004 CASA the range is only 78.1% to 81.5%.

Table 5: Mean Immunization Coverage Rate Estimates (%) Among Counties based on Population Density for the One-Year Old Cohort in Kansas, 2004 CASA.

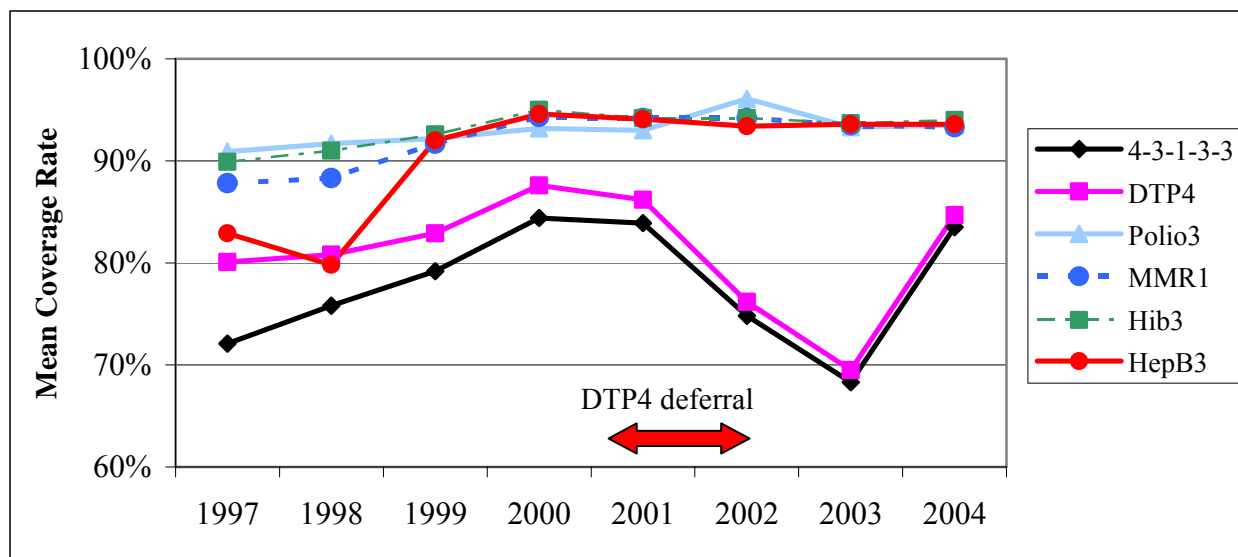
	Counties by Population Density - Collapsed Groups		
Vaccine	Sparsely Populated (n=68)	Moderately Populated (n=30)	Urban (n=5)
DTP3	82.5	79.3	80.6
Polio2	91.2	90.4	90.5
Hib2	92.5	89.6	89.5
HepB2	92.5	91.9	90.2
3-2-2-2	81.9	78.4	78.1

DISCUSSION

In the two-year old cohort, the number of local health departments achieving the 90% coverage goal was similar to the number of counties in 2003 except for DTP4, Var1, and 4-3-1-3-3 combination. The number of local health department reaching at least 90% increased for DTP4, 4-3-1-3-3 and Var1. Only nine counties have 90% or better coverage for PNU4. The county mean immunization coverage rates remained the same as last year for all single antigens except DTP4 and the 4-3-1-3-3 combination. From 2000 to 2003, mean coverage rates for the 4-3-1-3-3 declined by more than 16 percentage points. This is a reflection of the declining DTP4 mean coverage rates which have also declined each year since 2000. However in 2004, coverage rates for DTP4 and 4-3-1-3 increased by 15 percentage points. The mean coverage rate for 4-3-1-3-3 in 2004 was comparable to the mean coverage rate in 2001.

As a result of the deferring the fourth dose of DTP from March 2001 to July 2002, mean coverage rates for DTP4 decreased by 18 percentage points from 2000 to 2003. However since DTP4 has been reinstated, mean coverage rate levels are increasing and are only 3 percentage points less than in 2000 (Figure 4). Additionally, the mean coverage rates for 4-3-1-3-3 have increased with the reinstatement of DTP4.

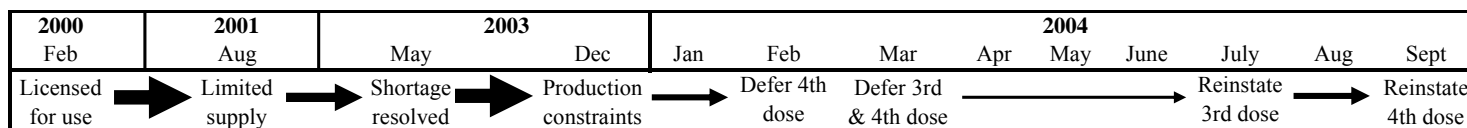
Figure 4: Mean Immunization Coverage Rates In the Two-Year Old Cohort at County Health Departments in Kansas, 1997-2004.



In February 2000, a pneumococcal conjugate vaccine (PNU) was licensed for use among infants and young children.⁴ This vaccine is recommended by ACIP for all children aged 2 to 23 months of age. Four doses of PNU are recommended for children who receive the first dose of PNU at 2-6 months of age. The four doses should be administered at 2, 4, 6, and 12-15 months of age. Children who begin the PNU series at 7 to 23 months of age receive only 3 doses of PNU.

Since it was licensed for use in 2000, several shortages and deferral of doses have occurred (Figure 5). The shortages in 2001 were disproportionately experienced by the public sector and by those private providers who depended on supply from the public sector. Children in both cohorts were born after the vaccine was licensed. These same children began vaccinations during the vaccine shortage. The effect of the shortages and deferrals are seen in the low coverage rates of PNU vaccine. In the two-year old cohort, the mean coverage rate for PNU4 is 50% and PNU3 mean coverage rates of 54% in the one-year old cohort.

Figure 5: Timeline of the Pneumococcal Conjugate Vaccine*.



*The thickness of the arrows represent the availability of the pneumococcal conjugate vaccine.

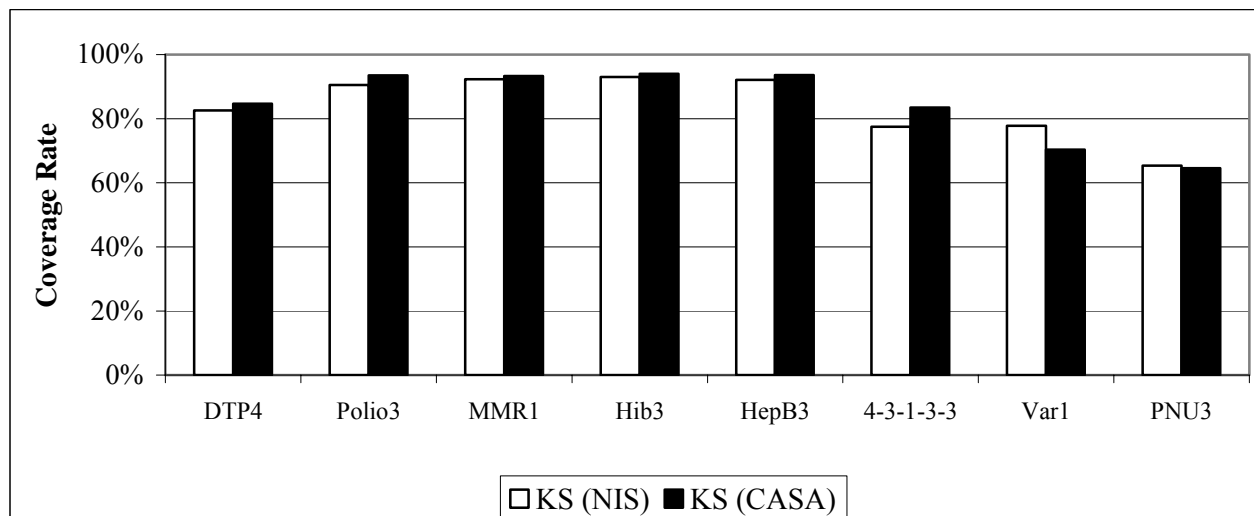
In both age cohorts, mean coverage rate estimates were greatest for those counties that are “sparsely populated” compared to the other two county groupings of population density. The mean coverage

⁴ Preventing Pneumococcal Disease Among Infants and Young Children: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2000;49 (No. RR-9).

rate estimates were similar to the estimates in 2003 CASA with the exception of DTP4 and 4-3-1-3-3. Mean coverage rate estimates were similar among the groups except for DTP4 and VAR1. For VAR1, “urban” and “moderately populated” had similar rate estimates but both with at least 7 percentage points less than “sparsely populated”. Estimates increased for DTP4 and 4-3-1-3-3 in all county groupings. The greatest increase of at least 24 percentage points occurred in the “moderately populated”.

The two-year old cohort results for 2004 CASA were compared to the National Immunization Survey (NIS) data results for 2004 (refers to a similar time period in the survey⁵). The NIS is a population-based sample. Despite the 2004 CASA not being population based, coverage rate results overall are similar to the 2004 NIS data for Kansas for all antigens (Figure 6).

Figure 6: Comparison of Immunization Coverage Rates in the Two-Year Old Cohort Between 2004 NIS for Kansas and 2004 CASA.



This study had several limitations. The first was that the survey sample is not a population-based. This study only includes children who attended a local health department for at least one of their immunizations and did not include children who attended for any reason, which might have resulted in an overestimation of coverage rates. On the other hand, an underestimation of coverage rates was also possible if immunization records fail to identify children who have moved or gone elsewhere (MOGE) for immunizations.

Despite the limitations, this survey served as an effective tool for assessing immunization coverage rates both at the state level and at the county level. When assessing coverage rates at the county level, the CASA is a useful tool for swiftly identifying problem areas and to assess the significance of under immunization of Kansas children. For these reasons, this assessment will continue to be used to track immunization coverage rates in Kansas.

⁵ Data for NIS was collected by the Centers for Disease Control and Prevention (CDC) through a telephone survey of randomly selected household. For accuracy, the healthcare providers (family physician, pediatricians, etc.) of the children included in the survey were contacted by mail. NIS estimates were calculated using both household and provider data.

Appendix 1: Kansas counties grouped together based on population density, 2004.

**Sparsely
Populated**

Anderson	Marion
Barber	Marshall
Brown	Morris
Chase	Morton
Chautauqua	Nemaha
Cheyenne	Ness
Clark	Norton
Clay	Osborne
Cloud	Ottawa
Coffey	Pawnee
Comanche	Phillips
Decatur	Pratt
Doniphan	Rawlins
Edwards	Republic
Elk	Rice
Ellsworth	Rooks
Gove	Rush
Graham	Russell
Grant	Scott
Gray	Sheridan
Greeley	Sherman
Greenwood	Sherman
Hamilton	Smith
Harper	Stafford
Haskell	Stanton
Hodgeman	Stevens
Jackson	Thomas
Jewell	Trego
Kearny	Wabaunsee
Kingman	Wallace
Kiowa	Washington
Lane	Wichita
Lincoln	Wilson
Linn	Woodson
Logan	

**Moderately
Populated**

Allen
Atchison
Barton
Butler
Cherokee
Cowley
Crawford
Dickinson
Ellis
Finney
Ford
Franklin
Geary
Harvey
Jefferson
Labette
Leavenworth
Lyon
McPherson
Miami
Montgomery
Neosho
Osage
Pottawatomie
Reno
Riley
Saline
Seward
Sumner

Urban

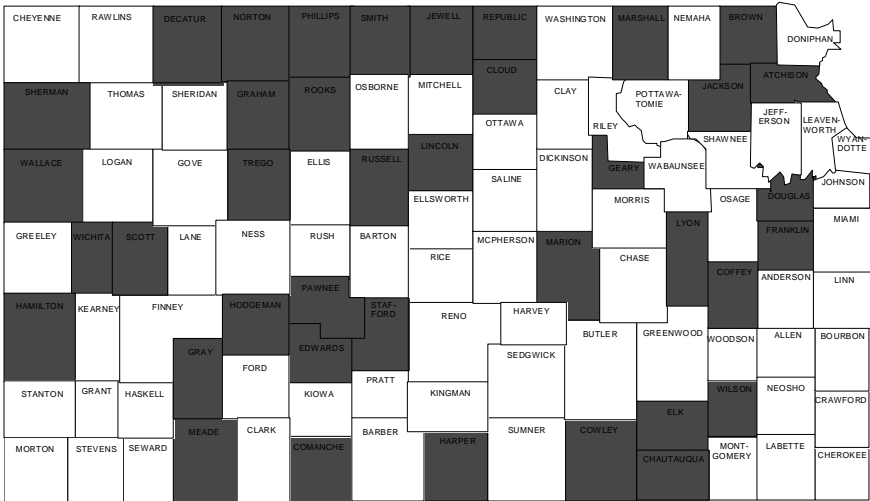
Douglas
Johnson
Sedgwick
Shawnee
Wyandotte



□ Sparsely Populated ■ Moderately Populated ■ Urban

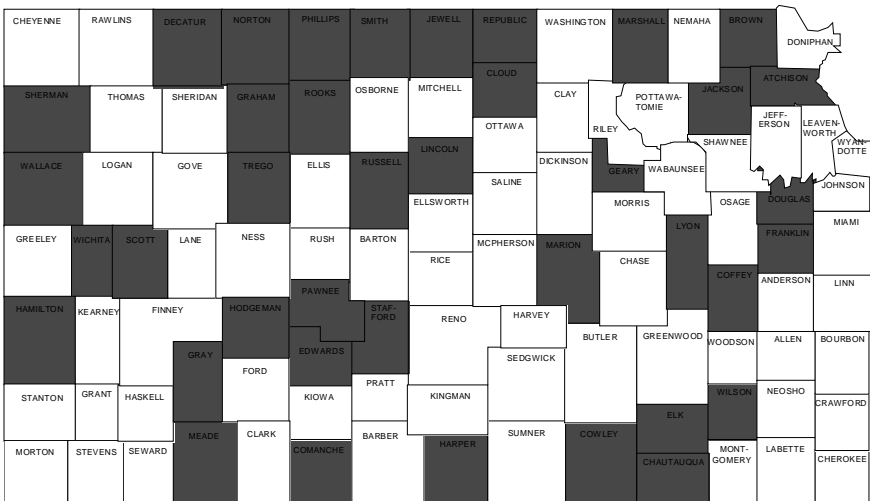
Appendix 2: Kansas maps of counties with at least 90% or better immunization coverage by age 2 years for the 4-3-1-3-3 series and individual vaccines, 2004 CASA.

4-3-1-3-3 Series for 2004 CASA



■ 90% or better coverage

DTP4 for 2004 CASA



■ 90% or better coverage

Polio3 for 2004 CASA



■ 90% or better coverage

MMR1 for 2004 CASA



■ 90% or better coverage

HIB3 for 2004 CASA



■ 90% or better coverage

HepB3 for 2004 CASA



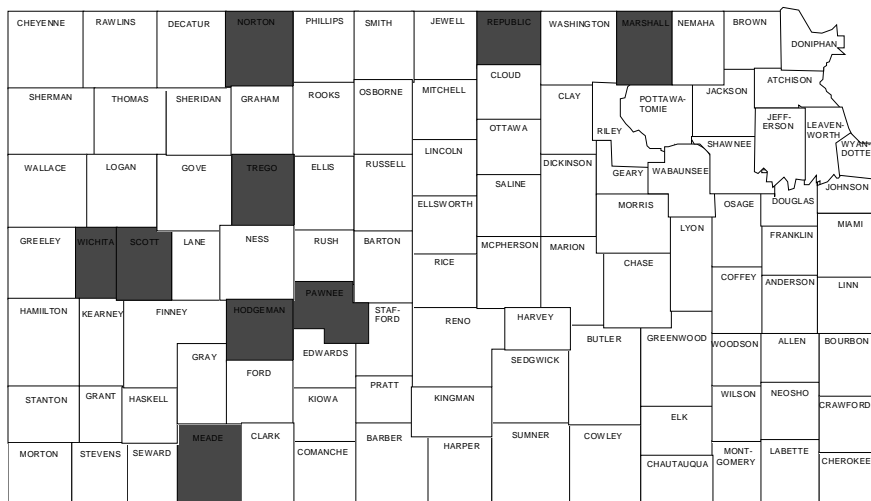
■ 90% or better coverage

VAR1 for 2004 CASA



■ 90% or better coverage

PNU3 for 2004 CASA



■ 90% or better coverage